

LETTER

FROM

THE SECRETARY OF WAR,

TRANSMITTING

Report of Maj. H. H. Benyaurd, Corps of Engineers, of survey of falls on Red River, La., and of Black River, Ark., and of Tehula Lake and Yallabusha River, Miss.

JANUARY 12, 1880.—Referred to the Committee on Commerce and ordered to be printed, with the accompanying documents.

WAR DEPARTMENT, WASHINGTON CITY,
January 10, 1880.

The Secretary of War has the honor to transmit to the United States Senate a letter from the Chief of Engineers, of the 8th instant, and accompanying copies of reports from Maj. H. H. Benyaurd, Corps of Engineers, of a survey, made under his direction, of the falls on Red River, near Alexandria, La., in compliance with the provisions of the river and harbor act of June 18, 1878; and of examinations of Black River, Arkansas, Tehula Lake and Yallabusha River, Mississippi, to comply with the requirements of the river and harbor act of March 3, 1879.

ALEX. RAMSEY,
Secretary of War.

The PRESIDENT
Of the United States Senate.

OFFICE OF THE CHIEF OF ENGINEERS,
Washington, D. C., January 8, 1880.

SIR: I have the honor to submit herewith copies of reports to this office from Maj. W. H. H. Benyaurd, Corps of Engineers, of the results of a survey of the falls on Red River, near Alexandria, La., with estimates of cost of improvement, made under his direction, in compliance with provisions of the river and harbor act of June 18, 1878, and of examinations of Black River, Ark., and Tehula Lake and Yallabusha River, Miss., in compliance with provisions of the river and harbor act of March 3, 1879.

Very respectfully, your obedient servant,

H. G. WRIGHT,
Chief of Engineers, Brig. & B't Maj. Gen. U. S. A.
Hon. ALEXANDER RAMSEY,
Secretary of War.

SURVEY OF THE FALLS ON RED RIVER, NEAR ALEXANDRIA, LA.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., December 20, 1879.

GENERAL: I have the honor to transmit herewith the following report of the survey of the falls of Alexandria, La., with estimates for the improvement of the same, made in accordance with the act of Congress approved June 18, 1878, and assigned to me by letter under date of July 8, 1878.

So long back as 1840, the State of Louisiana had taken the subject of the improvement of the falls of Alexandria under advisement, and appropriations were made at various times for that purpose. The work accomplished consisted mostly in the removal of portions of the rocky barrier constituting the upper and lower falls, of supposed sufficient width and depth to allow for the passage of the largest class of boats navigating the river.

While many of the most valuable reports of the State engineers upon the matter cannot be obtained, the board of State engineers of Louisiana, in their special report, in January, 1874, present abstracts from such as could be collected which tend to give a history of the various attempts made to improve the locality.

As they have an important bearing on the subject, as showing the views entertained as to what was considered the best methods of improvements, I will quote the extracts in their order as taken from the report referred to.

In Dunbar's report of 1840, he says in regard to the falls at Alexandria:

The next and greatest obstruction to the low-water navigation is the falls at Alexandria. This obstruction consists in a fall of three feet, at low-water, above Bayou Rapides, with two rapids one mile above, having a fall of one foot. The rock forming the bed of the river consists of an extremely soft and friable sandstone slightly impregnated with marl. The stone yields readily to the knife or any hard body, and may be crushed by the finger.

About fourteen hundred feet above the lower falls the channel divides, one (the main channel) running over to the eastern and the other keeping close to the western shore. In a choice as to which of the two channels should be cleared I had to consider two things—first, the comparative expense of the two, and, second, the beneficial results to be produced. If we cut the eastern passage, we take the one chosen by nature, and, in this instance, the most proper. If the western, we throw the whole force of the current against the banks upon which the town is built, and might cause the destruction of a large portion of the town. The expense is in favor of the eastern channel, and I shall accordingly make my estimate for it. The profile shows the section of the bed of the river, with the bar or beds of rock which it will be necessary to remove. The estimates are made for a channel sixty feet wide, with depths of six and eight feet.

Dunbar considered the passage giving a depth of eight feet of water over both falls as preferable, and so recommended it, the estimated cost being \$28,000.

It seems further that the legislature made an appropriation for the work, but nothing whatever was done, as it seems that Dunbar feared that the removal of the barrier would injure the navigation above. He says:

I desire to submit this matter again to the consideration of the board and to the legislature, and I was impelled to this course from a fear that when these obstructions were removed at the point where they now exist, new ones of a similar character would present themselves at a point higher up the river. Such is the opinion of many persons with whom I conversed on the subject, and who, I am inclined to think, have a good knowledge of the river. A fear that their opinion might be correct, and that the expenditure of this heavy sum, appropriated at a time when our State was so much embarrassed by its pecuniary responsibilities, might be made without a corresponding benefit, induced me to incur the responsibility of postponing the completion of the

contract; and I was strengthened in the propriety of this course from the fact that no injury could result from this delay, for the reason that the work can only be done when the water in the Red River is low. I now submit this matter to the legislature and yourselves for new instructions.

In 1852, A. D. Woolbridge says :

A canal or channel should be cut 50 feet wide through the falls at Alexandria, and all the water thrown into said channel by walls laid in cement upon the rocks, across the balance of the river. I am convinced were this done that the present amount of water passing over the falls would give from 5 to 7 feet depth in this channel, without in the least lowering the water above. In fact, that we should have better water in this channel than we now have on the bars above and below. The bars in Red River cannot be removed. They are composed of quicksand, with one or two or exceptions, and are constantly shifting with every stage of water, and with every accidental change of the current. In many places the only practicable channel is obstructed by fallen timber or snags. Were all these removed, at the lowest stage of water the navigation would be vastly improved, and perhaps never entirely suspended.

In 1853, in the report of George W. Morse, State engineer, we find :

I have thought it quite unnecessary that I should make a survey of the falls near Alexandria, in accordance with act No. 80 of the last legislature, as the work of removing the obstructions, I know was going on under the superintendence of Colonel De Russy, the able engineer appointed by the commissioners. I presume that after the examination and surveys which he has made, he will be able to demonstrate the utility of the work now in progress.

A stream which already brings to market about 300,000 bales of cotton, while its resources are not half developed, one-half of which, at least, pays one dollar extra on account of the obstructions, without counting the extra cost of transporting other articles, is worthy of the very best improvement which can be adopted.

It seems from this report that a contract had been made with Messrs. Maillefort & Raslorff, of New York, for the removal of a portion of the rock, with what success is shown by the following report.

In 1854, George W. Moore says :

It is probably my duty as State engineer to call the attention of your honorable body to the present situation of the falls in Red River at Alexandria, and to the generally bad condition of that stream. Commissioners were appointed and money appropriated for the removal of the falls by an act of the legislature, approved March 11, 1852. In the summer of 1853 an attempt was made to blast them out by Messrs. Maillefort & Raslorff, of New York, which certainly did not improve the condition of the river, and last year nothing was done, notwithstanding an additional appropriation was made for that purpose. It is high time that a stream which now brings to market nearly one-eighth of the cotton crop of the United States, and which will be doubled in the next ten years, should be relieved of such an embarrassing impediment to its navigation. I have not yet seen any reason to change the views expressed in my first annual report in reference to the necessity of locks at this point, except as to their location. I have had a good opportunity during the last summer to make examinations of the rock, and have such samples in my office as will show clearly its character, from which I judge that a crane properly arranged for dredging, and attached to one of our heaviest State boats, would without difficulty excavate the required channel through it. The rock at the falls, when wet, can be easily cut with an axe or a crowbar, and if the spoon attached to the crane should meet with any hard substance which it would be unable to remove, it could be dislodged with powder or a falling bar of iron. My examinations have convinced me that there is room enough on the north side, in the bed of the river, between the hill and the low water, in which to place a lock, which I would propose to construct partly of the hardest portion of the rock, and the rest of cast iron, the gates of which to be high enough to hold the water 2 or 3 feet above low-water mark only, so that when the river was up they should be open and entirely covered. Such a lock would not be very expensive if the excavations could be made with a dredge-boat, particularly as with her crane she would deposit the earth on the outside, so as to form a coffer-dam in the shallow water, into which a part of the basin might run. This impediment costs the State, in advanced prices of freight, not less than \$300,000 upon an average per year, and less than one-half of that sum would remove it. A lock here, and wing-dams in a few other places, and light-draught boats could at any time navigate the river from its mouth to Shreveport. There is always plenty of water, and all that we require besides the lock is to confine it. The importance of the stream demands more energetic appliances of improvement. The low-water of 1850 and 1854 should not discourage, but rather stimulate our exertions; for a judicious expenditure of a sufficient

sum to construct 20 or 30 miles of railroad would carry us through to Shreveport on 3½ feet water at any time without difficulty; and during an ordinary low-water season, such as has been experienced at any time, except in the years 1850 and 1854, we could easily obtain 4 feet. Our State boat, the Governor Herbert, went to Alexandria on the 23d of December, 1854, at the very time when the water was lower than ever before known, and we are sure that she draws 3½ feet. While the State is expending millions upon railroads, why should it not employ four or five hundred thousand dollars to properly improve the navigation of this great river, which must, even after the completion of the roads, continue to carry to market nine-tenths of the produce of its valley, even if left in its present condition?

From report of Louis Hébert, State engineer, 1856:

Nothing has been done, I believe, during the year, upon the falls at Alexandria. In my annual report I strongly recommended the construction of locks upon one or the other falls. I must here repeat my recommendations. Nothing else will do; and the large commerce of Red River (large even now, and increasing so as to be at some day almost incalculable) warrants any outlay, even to millions of dollars.

He next takes into consideration the project of rendering the Rapides and Jean de Jean a canal of circumnavigation around the falls, and proves that four locks would be necessary in each stream, and estimates that each lock would cost no less than \$35,000.

The rise of Red River in 1849 being 41 feet above the low-water of 1856, the locks would not prevent the overflow of the Rapides country.

From the reports of the various State engineers it will be seen that the following methods of overcoming the obstructions have been proposed:

To build a lock and dig a canal around the falls.

To open and enlarge the Bayou Rapides.

To remove the falls or cut a channel through the rocks.

To contract the water-way by wing-dams.

The only attempts made, however, to improve the falls consisted in cutting away a portion of the top, and also cutting a channel through the rocks.

In May, 1864, the fleet under Admiral Porter operating with the army under General Banks was caught by the low water above the falls, and was extricated from its perilous position by Colonel Bailey, engineer of the Nineteenth Army Corps, who built a dam across the lower falls, and wing-dams upon the upper.

The greater portion of Bailey's dam is still in existence. The old channel left by him through the middle of the structure is still open, but the river has, however, worked around the east end, causing a considerable erosion of the banks above Alexandria, and making a channel sufficiently wide and deep as to constitute the main channel of the river.

In 1874 Congress directed a survey of the falls to be made with a view to the improvement of the locality, and the work was assigned to Major Howell, whose report will be found in report of the Chief of Engineers for 1875, page 902 *et seq.* The report is very exhaustive of the subject and discusses the various projects entertained for the improvement, and recommends the building of a dam at the foot of the upper falls, with a lock and navigable chute, the estimated cost being \$97,652.99. For full details of the project, reference may be had to Major Howell's report as above.

In the survey made under my direction by Assistant Engineer W. M. Rees, Major Howell's map was taken as a guide, and the tracing herewith is from that map, with additional soundings and cross-sections. The character of the rock forming the falls is such that no change could result from the action of the water, and the channel over the upper falls is still in the same condition as above reported. The additional soundings and references are noted in red; those of the old are in black. In

addition also to the discharge observations I caused a survey of the river to be made extending up to Colfax, twenty-five miles above, with separate surveys of the various shoal places at present existing.

The government is at present undertaking the improvement of Red River from Fulton, Ark., to the mouth, in the removal of what may be termed accidental obstructions, such as rafts, snags, &c.; also the closing of Tones Bayou; also the improvement of the mouth, which latter is at present under consideration, as it interests not only the navigation of Red River and its tributaries but also the Atchafalaya and its connecting network of navigable channels and bayous.

Nothing yet, however, has been attempted in the way of the improvement of the various bars and shoal crossings now interrupting navigation, but which will be attempted so soon as sufficient appropriations are made to carry on such work. The improvement of the falls must necessarily constitute another work, a part of whatever plan may be adopted for giving good low-water navigation in Old River.

Now regarding the depth required for navigation, Major Howell, in his report, states that—

The depth of the channel over the upper falls (3 feet) would be sufficient at extreme low-water for such vessels as can engage in the low-water trade of Red River, if it were not for the narrowness of the channel, its abrupt turns, the velocity of the current through it, and its rock bottom.

The statement as to the sufficiency of depth is based on information gained from steamboat men who have for years been engaged in the Red River trade, to the effect that during two months of each year they count on only 2 feet; for two months more on only 3 feet; and for the remainder of the year on excellent navigation from the Mississippi to Alexandria. From Alexandria to Shreveport, during extreme low-water, a draught of 2 feet may be carried, with considerable difficulty, over sand-bars affording a depth of water of only 20 inches.

When there is 5 feet of water over the upper falls, 8 feet may be carried from them to Grand Ecore, and 6 feet to Shreveport.

Information from the same parties was to the effect that, with the water in the river at Alexandria 3 feet higher than at the time of survey, boats suited to low-water navigation of the river are able to pass the falls without trouble. Three feet higher would make the reading on the United States gauge at the beginning of this navigable stage $1\frac{3}{10}$ above zero.

On this latter point my gauge at Alexandria shows that from 1872 to 1879 there were the following number of days upon which the gauge reading was below $1\frac{3}{10}$, and that consequently the navigation over the falls might be considered as virtually suspended—

1872.	Days.
September	13
October	31
November	30
December	19
Total for 1872	93
1873.	
September	9
October	15
Total for 1873	24
1874.	
August	13
September	30
October	14
November	21
December	17
Total for 1874	95
1875.	
July	7
August	10

1872.		Days.
October.....		7
November.....		28
December.....		10
Total for 1872		45
1873.		
September.....		3
October.....		31
November.....		30
December.....		31
Total for 1873		95
1874.		
January.....		23
August.....		16
September.....		30
October.....		22
Total for 1874		91
1875.		
October.....		28
November.....		30
December.....		8
Total for 1875		66
* 1876.		
June.....		2
July.....		31
August.....		31
September.....		30
October.....		31
November.....		30
December.....		20
Total for 1876		175
Total from 1872 to 1876, inclusive		701

The water in Red River since the survey this year has been lower than ever known before. My gauge at Shreveport, showing a stage 3.5 below the low water of 1873, and 2.5 below the low water of 1872. At Alexandria it was .5 lower than 1872, or 3.1 below the zero of the gauge at that place. From Alexandria to the mouth, not over 20 inches of water could be found upon the great majority of bars.

As before stated, as the government has undertaken to improve the navigation of Red River, the improvement of the falls must necessarily be taken into consideration. If it be found necessary to provide for the passage of the upper falls by a dam with a lock and navigable chute, that proposed by Major Howell I deem the best under the circumstances, requiring, however, an enlargement of the lock for the size of boats that could navigate the river when there is a 5-foot stage of water, for we find among the boats the Laura Lee, 210 feet long; Kate Kinney, 200; and the Jesse K. Bell, 225.

In considering the method of improvement by cutting a channel through the upper falls, I do not think that the danger of draining the pond above or injuring the navigation of that section of the river need at all be apprehended. The obstruction acting as a dam, the back-water proportionately increases the depth over the bottom and tends to improve the navigation above, but Red River being a sedimentary stream, the check given to its current by the back water causes the sediment to be deposited throughout the entire distance of the retardation, and it is possible that the falls shoal rather than deepen the water

* Not yet completed.

above. Upon the removal of the obstruction the alluvial deposits would all be washed out by the increased velocity of the current.

The survey made by Mr. Rees shows that the average fall from Colfax to the head of the upper falls, a distance of 24 miles, is .267 feet per mile, with 5 shoal places in that distance, the only rocky formation found being De Loche's rock, about 5 miles below Colfax. These, however, project from the bank, and there is a good depth of water in the river at that locality.

The length of the upper falls is 935 feet; with a total fall (low-water slope of 1874) of 2.5 feet.

The length of lower falls is 500 feet; total fall (low-water slope of 1874) is .5 feet.

Intermediate reach, 4,565 feet; (low-water slope of 1874) .5 feet.

As it is not contemplated to cut away the entire ledge to a sufficient depth for navigation purposes, but only a channel sufficiently wide for the passage of a steamer and loaded barge, the lowering of the slope above I do not deem will be sufficient to affect the navigation, and the increased velocity will not be great enough to cause any great additional trouble to the steamers.

For the upper falls it is proposed to take the line shown on the tracing herewith along the eastern shore, and excavate a channel so as to obtain a width of 75 feet, and a permanent depth of $4\frac{1}{2}$ feet below the plane of low water of 1874; as at this latter stage there was a scant 3 feet over the upper falls, the bottom of the cut would give, say, an average additional cutting of $1\frac{1}{2}$ feet. In the proposed cut it has been the aim to take advantage, as far as possible, of existing depth and channel direction. The total length of the cut is 1,150 feet.

On the lower falls it is proposed to build a dam with the rock taken out of the cut above, from the point above the cutting on the Alexandria side over to the end of the Bailey dam, and allow the old channel through the dam to become the new one. The raising of the water surface above the lower falls by this improvement will tend to diminish the fall caused by the cut through the upper falls.

The estimated cost of this improvement, excavating 5,626 cubic yards of rock, with coffer-dam, &c., and building dam, is \$39,945.60.

Very respectfully, your obedient servant,

W. H. H. BENYAURD;
Major of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

EXAMINATION OF BLACK RIVER, MISSOURI AND ARKANSAS.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., December 20, 1879.

GENERAL: I have the honor to present the following report upon the examination of Black River, Missouri and Arkansas, provided for by act of Congress approved March 3, 1879, and assigned to me by letter dated April 25, 1879.

This examination was made with a view of determining the character of the stream, the nature of the obstructions, and cost of removal of same, and the amount of commerce to be benefited. The operations in the field were conducted by Mr. J. D. McKown, assistant engineer, and extended from Poplar Bluff, Mo., to Jacksonport, Ark.

Examinations of this stream were made under the direction of Lieutenant Colonel Reynolds in 1871, by Mr. John S. Tennyson, from Pocahontas to the mouth, and in 1872, by Mr. A. H. Blaisdell, from Poplar Bluff to Pocahontas. From these different reports, full and detailed information regarding the obstructions has been obtained, which enables us to present estimates for the improvement of the river.

Black River is a tributary of White River, heading in the southeastern part of Missouri, and, flowing in a general southwesterly direction, empties into the White about half a mile above Jacksonport, Ark. It has a number of tributaries, the principal ones being Cane Creek, Current River, and Touche de Mas, while at different points it divides itself into two branches, forming separate channels, such as Dans River, Little River, and Catharine Slough. In addition, there are numerous sloughs, leading off from the main river into the bottom lands on either side; the drainage area of the whole being estimated at about 8,000 square miles.

It is considered necessary to improve only that portion of the river between Poplar Bluff and the mouth; the estimated distance being about 300 miles.

The banks of the river are of a firm material, but little liable to cave, and therefore any improvement that may be undertaken would be comparatively permanent.

During extreme high-water the banks and bottom lands are in many places liable to overflow. The extremes of high-water vary from 18.5 feet at Poplar Bluff to 26.25 feet at Pocahontas. The river bed is generally sandy, on its lower parts sand and clay sometimes mingled with mussel shells and fine gravel. The general width between banks on the upper section of the river is about 130 feet, and on the lower, say below the mouth of Current River, the average width is about 250 feet.

The general obstructions to navigation are shoals, snags, logs, and leaning timber. About four miles above the head of Little River, the Saint Louis, Iron Mountain and Southern Railroad has constructed a bridge of a single fixed span of 160 feet across the river, the height of the lower chord of the bridge being only 11 feet above low-water; it is therefore a complete obstruction to the navigation of the river above.

For convenience the river is divided into two divisions, viz, from Poplar Bluff to Current River, a distance of about 146 miles, and from Current River to the junction with the White. In the first division there are fifty-seven shoals, covering an aggregate length of 37 miles, the depth of water over these shoals being never less than two feet except in one or two instances. In the second division there are twenty-one shoal places, the depth of water over them varying from two feet to two and one half feet. A list of these shoals taken from the reports above referred to are here inserted:

Name.	Length.	Channel in low-water.		Remarks.
		Depth.	Width.	
	<i>Feet.</i>	<i>Feet.</i>	<i>Feet.</i>	
Henderson.....	600	2 to 4	40	Gravel and sand bottom; logs in channel.
No name.....	600	2 to 3	60	Sand bottom.
Do.....	300	3 to 4	30	Sand bottom.
Do.....	150	2.5	35	Gravel and sand bottom.
Do.....	300	2.6	35	Gravel and sand bottom.
Do.....	150	3	30	} Bottom of snags imbedded in sand.
Do.....	150	3	35	
Do.....	175	2.5 to 3	30	
Do.....	250	2.5	30	
Do.....	300	3	40	} Used as a ford.
Do.....	220	3	40	
Do.....	100	3	30	
Do.....	120	3	25	
Do.....	75	2.5	40	} All these shoals occur in bends. The river itself is very narrow in this locality.
Do.....	100	2.5	30	
Do.....	150	3	30	
Do.....	300	2.5	40	
Do.....	150	2.8	30	
Do.....	150	2.5	30	
Do.....	1,000	2.5	30	
Do.....	400	3	30	
Do.....	150	3	20	} At mouth of Dan's River.
Do.....	600	3	40	
Do.....	350	3	30	
Do.....	100	3.5	50	
Do.....	250	3.2	40	} In bend Roaring "cut-off."
Do.....	400	2 to 3.5	40	
Do.....	650	2 to 3	30	
Do.....	150	2 to 2.5	30	
Do.....	250	3	40	} Sand, with muscle-shells.
Do.....	1,800	2 to 3	90	
Do.....	300	2 to 3	20	
Do.....	100	2.5	30	
Do.....	350	3	30	} Between these limits there is a general good depth of water.
Do.....	300	2.8	40	
Do.....	200	3.3	35	
Do.....	300	3.3	35	
Do.....	200	3	40	} In many of these shoals the bottom is overgrown by a species of grass which renders the bottom very hard.
Do.....	75	3.5	30	
Do.....	250	3	50	
Do.....	100	2.3 to 3	40	
Do.....	2,400	2.5 to 3	30	} Fall .6 } Rocky bottom.
Do.....	250	2.5 to 3	40	
Do.....	250	1.5 to 3.5	50	
Do.....	300	3 to 4.5	50	
Do.....	100	2 to 3	50	} Fall .25 } Rocky bottom.
Do.....	200	1.5 to 3.5	50	
Do.....	300	2.5	50	
Do.....	600	2.5	40	
Do.....	100	2.2	40	} Rocky bottom; fall .25.
Cox's Ford.....	1,000	2	180	
Fish Trap.....	75	2.5	30	} Rocky bottom.
No name.....	900	2.5	50	
Do.....	150	2	30	} Sand and muscle-shells on bottom.
Rocky Ford.....	300	2 to 2.5	40	
Russell's Ferry.....	450	3	60	} Rocky bottom.
No name.....	900	2 to 3	60	
Shoals of Pocahontas.....	800	2.4	40	} Gravel bottom.
No name.....	400	2.6	40	
Do.....	500	2.4	40	} Two large loose rocks in channel.
Do.....	350	2.6	45	
Do.....	600	2	40	} Gravel bottom.
Do.....	500	2.4	45	
Do.....	300	2.4	35	} Do.
Spring River.....	700	2.4	40	
Devil's Race Paths.....	850	2.3	35	} Do.
Lower Devil's Race Path.....	700	2.3	35	
Eagle's Nest.....	350	1.10	33	} Do.
No name.....	450	2.3	35	
Powhatan.....	900	2.3	35	} Do.
No name.....	400	2.3	35	
Do.....	350	2.3	40	} Logs on the bottom.
Do.....	500	2.6	40	
Tim's Victory.....	350	2.6	33	} Gravel bottom.
Berkeley's.....	350	2.5	40	
Little Paroquitt.....	500	2.6	40	} Gravel and logs.
Paroquitt.....	450	2.6	45	
No name.....	350	2.6	40	Gravel bottom.

In addition to the shoals there are a great number of leaning trees which should be cut down, and numerous snags that ought to be removed.

Some improvements were attempted in former years upon the upper Black by the State of Missouri, the money being raised by donation of swamp lands; nothing however, was attempted beyond cutting down leaning timber and removing snags in the vicinity of Poplar Bluff.

The stream is regarded as affording very good facilities for navigation. A regular line of boats has for several years past been plying between points on the lower White and Pocahontas on the Black. If the improvement of the river be carried on, it will add greatly to the commercial and agricultural interests of the country tributary to the river.

Regarding the improvement, as the character of the stream is such as not to admit of its navigation by boats of a large size or carrying capacity during the low-water season, it is recommended to remove the snags, logs, &c., cut down the leaning timber, improve several of the shoal places, and close up several of the small sloughs where the channel is divided, thus concentrating the water into single channels.

Above the mouth of Current River it is recommended to widen a few of the shoal places, otherwise to confine the work to the removal of snags, &c., and the cutting down of leaning timber; also, at the head of Big Island, where the river divides itself into two channels, to put a dam across the head of Little River, and confine the water to the main channel. A few small sloughs below would require similar treatment; about 500 feet of dam, including that at Little River, would be sufficient for the upper division.

Below the mouth of Current River, in addition to leaning timber, &c., there are three shoals requiring improvements, viz: Devil's Race Path, Eagle Nest Shoals, and shoals at the mouth of river. The Devil's Race Path Shoal is of gravel bottom. The water is divided into two channels and could be improved by constructing a dam, closing up one of the chutes.

Eagle's Nest shoal is also gravel bottom. It has the least depth over it of all the shoal places noted—only about 22 inches at extreme low water. A wing-dam to contract the waterway and deepen the channel would improve it.

The shoal at the mouth is probably the most troublesome. Sunken logs firmly imbedded in the bottom obstruct the channel, rendering the passage of steamers difficult and somewhat dangerous at low water. If these were removed, and a low dam built, it would make a desirable improvement.

For the improvement of Black River I estimate as follows:

1 small light-draught boat.....	\$20,060
2 seasons' work, 7 months in each season, at \$2,200 per month.....	30,800
Cutting trees along the bank, two seasons' work.....	8,000
3,500 feet of dam, at \$4 per foot.....	14,000
Engineering and contingencies.....	8,000
	<hr/>
	80,800

I have estimated, as will be observed, for a small light-draught snagboat. Such a one is required not only on Black River, but on many other small streams of like character that need improving in this section of the country, and upon which the ordinary light-draught snagboats now in service cannot be used.

COMMERCIAL STATISTICS.

From the Upper Black great quantities of staves are taken for export to foreign ports, and from the Lower Black it is estimated that from 10,000 to 12,000 bales of cotton are shipped to the Memphis and other markets, and other shipments (amount not known) go over the Saint Louis and Iron Mountain Railroad to Saint Louis. If the river were improved, adding additional facilities for handling the crops, there is no doubt but what the cotton shipments would be greatly increased.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Major of Engineers.

Brig. Gen. H. G. WRIGHT.
Chief of Engineers, U. S. A.

EXAMINATION OF TCHULA LAKE, MISSISSIPPI.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., December 20, 1879.

GENERAL: I have the honor to make the following report upon the examination of Tchula River (or lake, as it is called), Mississippi, with a view to the improvement of the same, in accordance with the act of Congress approved March 3, 1879.

Having the snagboat Meigs in the Yazoo and in the vicinity of Tchula Lake, I directed Captain Straszer to make the examination of the stream. From his report, and from information received from the Mississippi and Yazoo River Packet Company in regard to the commerce of the stream, sufficient information has been obtained upon which to estimate for the improvement.

When the Yazoo reaches the head of Honey Island, it divides itself into two branches—the westerly one retaining the name, the Yazoo, while the easterly and narrower branch is named Tchula Lake or River. The distance from the head to the foot of the island, where the two branches again unite, is about 80 miles.

In the lower river, the distance between banks is about 125 feet, narrowing to about 80 feet proceeding up towards Tchula City, about 40 miles distant from the foot of the island. From Tchula City to the head of the island the width between banks varies considerably, being very narrow for the last few miles. It is only during the existence of a moderate stage of water that boats are enabled to enter and navigate this narrow channel.

The principal obstructions to navigation consist of a number of sawyers and cypress logs in the lower part of the river, and leaning timber all the way from the foot to the head of the island on both banks; also logs stretching out from the banks, some of them partly cut off.

The country along the river is highly cultivated, and very productive plantations join one another. The amount of cotton raised is estimated at about 20,000 bales, about one-half of which is brought out through the lake when there is sufficient water for navigation, and the remainder is hauled to the Yazoo, where there is navigation all the year round. Were Tchula Lake improved, so as to admit boats of a light draught to enter earlier in the season, no doubt the greater portion of the crop would come out by that channel.

The work of improvement will consist in the removal of the snags, cutting off the outcropping logs, and felling the overhanging trees.

As the work could all be done in one low-water season, I do not deem

it necessary to provide a special outfit therefor, but to charter a light-draught steamer with the necessary machinery, &c., such as I had on the Sunflower last season, and operate with her.

The estimated cost of the work is \$10,000.

Very respectfully, your obedient servant.

W. H. H. BENYAURD,
Major of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

EXAMINATION OF YALLABUSHA RIVER, MISSISSIPPI.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., December 20, 1879.

GENERAL: I have the honor to submit the following report upon an examination of the Yallabusha River, Mississippi, provided for by act of Congress, approved March 3, 1879, and assigned to me by letter of April 25, 1879.

The examination was made by Mr. W. M. Rees, assistant engineer, whose report will be found annexed, and was made with a view of determining the character and extent of the obstructions to navigation, with estimated cost of removal, and the nature and extent of the commerce to be benefitted.

The Yallabusha is a small stream (estimated to be about 90 miles in length), and has its source in Calhoun County. After flowing through Grenada and Le Flore Counties, it unites with the Tallahatchie and forms the Yazoo River. The examination shows that, like all the streams in that section of the country and in the Yazoo basin, the main obstructions to navigation are snags, sunken logs, and leaning timber, the removal of which constitutes the principal work to be carried on with a view of improving the navigation of the stream, and of giving increased facilities for the shipment of cotton, and the return of plantation supplies, and other freights.

The country through which the Yallabusha runs is very sparsely settled, and in a number of places the land adjoining the river is inundated at a high stage of water. The shipments are mainly from the plantations back from the river.

Under the present condition of affairs, Grenada is the principal shipping point, from which place, annually, the amount of cotton shipped is estimated at 12,000 bales. The greater portion of this finds its way by rail to New Orleans. The shipment by river last season amounted to 3,000 to 3,600 bales. Were the river improved, no doubt the greater portion that now goes by rail would find its way out by boat, and at reduced rates of freight.

In the present condition of affairs it is deemed only necessary to cut down the leaning timber and remove the rack heaps and the most dangerous snags. For this purpose no snagboat is necessary. During the lowest stage of water a party can be sent along the river with the necessary tools, &c., and everything can be cut out.

The estimated cost of this improvement is \$7,000.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Major of Engineers.

Brig. Gen. H. G. WRIGHT,
Chief of Engineers, U. S. A.

REPORT OF MR. W. MARSHALL REES, ASSISTANT ENGINEER.

MEMPHIS, TENN., *December 11, 1879.*

MAJOR: I have the honor to submit the following report upon an examination of Yallahusha River, Mississippi, made under instructions received from you December 2, 1879:

On December 3 I proceeded, with a skiff and two experienced skiffmen, to Grenada, Miss. December 4 and 5 being rainy, I started down the river on the 6th and reached its mouth on the 8th, a distance which I estimate to be about 90 miles.

The Yallahusha River has its source in Calhoun County, and, flowing through Grenada and Le Flore Counties, unites with the Tallahatchie, to form the Yazoo River, at a point four or five miles above Greenwood, Miss., and about 260 miles from the mouth of the Yazoo.

Five miles above Grenada it receives a large tributary from the right and north side called Schooner River, and immediately above the town another large tributary called Bogue Creek comes in from the left side. Between Grenada and the mouth there are several small tributaries, nearly all on the right and north side. Before leaving Grenada I made inquiries from prominent citizens both as to the navigation of the river and the trade and resources of the adjacent country.

During the winter of 1878-'79, three boats, of from 600 to 800 bales (of cotton) capacity, reached Grenada, one boat making three trips, or, in all, five to six trips, which, at 600 bales per trip, gives from 3,000 to 3,600 bales carried from this region last year by steamboats. The total amount of cotton then shipped from Grenada was 12,000 bales, and had the boating facilities been sufficient, fully one-half would have been shipped by boat. The boats also bring up supplies (provisions, &c.).

Prior to the late war, boats of 1,200 to 1,500 bales' capacity reached Grenada, which place has generally been considered the head of steamboat navigation. Keelboats carrying 300 to 400 bales, have run as far up as Graysport, 12 miles above. The railroad bridge crossing the river at Grenada is a bar to navigation above.

The country through which this river runs is sparsely settled near its banks; in most places the land is subject to annual overflow, in part caused by back water from the Yazoo River. The overflowed district extends from $\frac{1}{2}$ to 1 mile inland, where hill or rolling country is reached, much of which is settled, producing principally cotton.

At about 30 or 35 miles below Grenada, the hill country ends, and from thence to its mouth the river flows through a flat, bottom country for 60 miles, nearly all of which is overflowed almost annually for miles back from the river.

Along the entire portion of the river examined I counted 10 clearings and six or seven steamboat landings. As the river was reported to be about four feet above low-water when I left Grenada, I was not able to determine the obstructions in the channel with as much accuracy as I would wish. During my trip down, the river was slowly rising. The rise at Greenwood on Yazoo River was reported to me as 5 feet above low-water on December 8.

I learned from several sources that in extreme low-water numerous snags are shown, making the river in many places impassable to a skiff. With the river 4 feet above low-water I counted 150 snags in the channel, besides ten or twelve rack heaps (three or four of the largest being about 25 by 50 yards, and occupying about half the width of the river. A considerable number of the projecting snags appeared to be branches of trees which had fallen in the channel; many can readily be removed by cutting up during low-water.

For about forty miles below Grenada the banks have been cleared of overhanging trees. This work was done during the past summer at an expense of \$600, paid by the county of Grenada.

Four years ago the grangers' society expended several hundred dollars on similar work. Much of the timber and brush cut last summer is lodged in the river, the greater part of which will, I think, go off during high-water.

On the lower fifty-five or sixty miles there is considerable overhanging timber, forming obstructions to navigation; they are oak, willow, sycamore, and some few cypress, mostly of medium size. Both banks of the river from Grenada to the mouth are covered with timber; the greater portion of that suitable for lumber is oak, of which there is a large quantity. At a few places where the bluffs reach the river, pine is seen. Near the mouth is some cypress.

The width of the river at the present stage of water is from forty to sixty yards. In a few places, nearer the mouth, reaching seventy to eighty yards.

The banks to a height of ten or twelve feet are in general steep, caving but in a few places. Owing to the rapidity with which the water falls at times, boats risk running to Grenada only during high-water (six to ten feet above low-water). At the present stage (four feet) there is a good current. I estimate the velocity in the channel at from two to three feet per second, or one and a half to two miles per hour. The country passed through is alluvial with more sand in the upper part, producing from one-half bale of cotton in the uplands to one bale per acre on the bottoms.

A part of the hill lands is much broken by ravines and gullies, caused by the rain waters, thus making a considerable portion unfit for profitable cultivation. Much of the hill lands are said to be very inferior cotton lands.

The freight rates on cotton from Grenada to New Orleans are via railroad, \$3.50 per bale; via steamboat last winter, \$2.50 per bale, and when improvements are made in the river, the steamboat lines agree to carry cotton to New Orleans for \$2 per bale; the latter is the present price from Greenwood on the Yazoo.

In conclusion from lack of definite knowledge concerning the river during low-water, I do not feel justified to recommend its improvement for permanent navigation. Still I am of the opinion that a small sum can be profitably expended to remove such obstructions as will insure the safe passage of boats during at least four months of the year, which time the water is said to be three or four feet above extreme low-water. Such improvements to consist in the cutting of overhanging trees and the removal of rack heaps, and the most prominent snags, thereby insuring navigation to small boats. I therefore recommend, as the amount that can be profitably expended, the sum of \$7,000.

Very respectfully, your obedient servant,

W. MARSHALL REES,
Assistant Engineer.

Maj. W. H. H. BENYAURD,
Corps of Engineers, United States Army.

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